

PROGRAM STATUS REPORT

Air Force Research Laboratory / Materials & Manufacturing Directorate /
Manufacturing Technology Division / Wright-Patterson AFB, Ohio
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Summer 1998

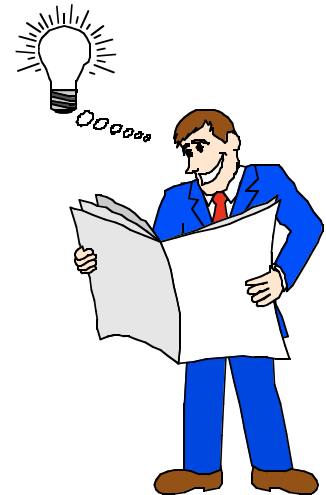
Materials and Manufacturing Directorate consolidating publications

This is the last issue of the Program Status Report as you know it.

As most readers of this publication are aware by now, the former Materials Directorate and Manufacturing Technology Directorate were combined to form the Materials and Manufacturing Directorate. The two former directorates had quarterly publications which were distinct, yet somewhat similar.

The Materials Technology Highlights, a four-page report published by the former Materials Directorate, highlighted some of the directorate's success stories and current initiatives, had a calendar of events, and listed recently completed and started contracts. The former Manufacturing Technology Directorate's Program Status Report, a 16-page document, similarly highlighted successes and current initiatives, described upcoming events, and projected contracts coming to completion. It also provided a listing of various reports and videos available.

In the interest of serving both audiences in the most efficient and economical manner, these publications are being combined to form a completely new product. This product will look somewhat different, but it will still contain articles on the directorate's successes, current initiatives, and upcoming events. Additionally, it will have more indepth articles, and will evolve as necessary to serve the needs of the directorate.



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Science and Technology for Tomorrow's Aerospace Force

U.S. producers of gallium arsenide wafers double market share during DoD project

Program contributes to dramatic turnaround in key semiconductor industry

Representatives of the Department of Defense and industry recently celebrated the completion of a four-year project which strengthened the U.S. industrial base for gallium arsenide (GaAs) wafers.

GaAs wafers are critical for use in a variety of electronic applications such as radars, smart weapons, electronic warfare, and communications. Integrated circuits based on GaAs substrates enable many of the leading-edge technologies in major weapon systems, and also are key components in cellular communications, wireless networks, and GPS (Global Positioning System) receivers.

In the Pentagon ceremony, Deputy Undersecretary of Defense (International and Commercial Programs) Page Hoeper described the project as an enormous success. "The three U.S. producers were 'also-rans' in the gallium arsenide market when this project was initiated in 1994. But now, these companies dominate the U.S. and world markets with a 60-percent market share and world-class product quality. More importantly, DoD is reaping benefits in many different weapons programs. Electronic systems using gallium arsenide technology are cheaper, more reliable, and more advanced, due to improvements made during this Title III project."

The semi-insulating GaAs wafer project was initiated under the Defense Production Act, Title III Program, which promotes creation and strengthening of domestic industrial capabilities to support national security needs. Recent Title III projects have focused on developing efficient, low-cost production capabilities for advanced technologies. The primary goal of such projects is to enable and promote early insertion of new technologies into weapon systems at an affordable cost.

The Title III Program is executed by the Air Force Research Laboratory (AFRL) Materials and Manufacturing Directorate, Manufacturing Technology Division at Wright-Patterson Air Force Base. Division project managers began the gallium arsenide project to develop a competitive domestic capability for producing semi-insulating (SI) GaAs wafers. "Prior to the Title III initiative, Japanese firms dominated gallium arsenide wafer production with 70 percent of both the U.S. and world markets and a superior material to that produced by the U.S. companies," said Mike Corridore, Chief of Defense Production Act, Title III Program. "The competitive position of the U.S. producers was weak and at risk of declining even further. We were facing the prospect of having little or no production capacity in a year or two for this critical electronic material."

The three Title III contractors for the SI GaAs wafer project were American Xtal Technology (AXT) in Fremont, Calif.; Litton Airtron in Morris Plains, N.J.; and M/A-COM in Lowell, Mass.

Dr. Theodore Young, Senior Vice President for Marketing at AXT, credited the government program. "Title III gave AXT the impetus to improve its quality control, increase its capacity and enhance its technical marketing network." Jack Frost, Manager of Quality Systems at Litton

.....
• *Project Engineer:* •

• **John Blevins** •

• **AFRL/MLMP** •

• **(937) 255-3701** •

• **ext. 226** •

• *Contract Number:* •

• **Numerous** •
.....

Airtron, agreed. "The Title III Program helped us establish a world-class program..." Bob Ochrym, Litton Airtron's Director of Sales and Marketing said, "Litton Airtron increased its world market share of the GaAs substrate market from 12 percent to 26 percent, becoming the world's largest during the first year of Title III. The strategic and marketing planning, technical customer support and advertising initiatives supported by Title III enabled us to gain and sustain this market leadership position."

Sales of GaAs wafers by these contractors are now more than five times the 1994 level, and the dollar value of these sales has more than tripled over the life of the project, even though the average wafer price has declined by more than one third. Production capacity of the three domestic producers has increased by more than 200 percent and production yields have more than doubled over this period, as well.

"The GaAs industry has made great progress as a whole and these substrate suppliers have all been able to keep up with device manufacturers' technical and quantity requirements as a result of the program," concluded Dr. David Miller, Vice President and General Manager of Litton Airtron.

Key personnel from AFRL were John Blevins, Title III Project Engineer, and Laura Rea, Project Sponsor, both of the Materials and Manufacturing Directorate, and Dr. David Weyburne, Project Sponsor, from the Sensors Directorate.



Increased boule sizes reduce losses and result in more wafers per boule

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Reader Response
Number 1

End-of-contract demonstration scheduled

An end-of-contract demonstration for contract F33615-96-C-5107, Metal Forming Tool Design, will be held on August 25, 1998. The agenda will also include a demonstration of the compatible Metal Forming Simulation software developed under a separate ManTech contract. For details on the location and time of the demonstration, contact the project engineer, Marvin Gale, at (937) 255-7278, or galeml@ml.wpafb.af.mil.

OPNET

Industrial base simulation identifies critical item shortfalls, estimates replenishment time

Under a project with the Air Force Research Laboratory's Materials and Manufacturing Directorate, Decision Sciences Incorporated (DSI) completed the Operations Network (OPNET) Industrial Base Simulation to provide an advanced tool and spin-off methodologies for assessing and analyzing readiness levels/capabilities of critical sectors of the U.S. replenishment structure. OPNET identifies current and/or future shortfalls in war reserve material, and has been used specifically for war-consumables, e.g. munitions.

The first OPNET customer, highlighting early program management capability, was the BSU-93 Air Inflatable Retarder for the M-117 Demolition Bomb. The final OPNET version was proofed with Advanced Medium Range Air-to-Air Missile Lot IV data, showcasing its enhanced utility for program management. OPNET should be investigated as to its possible applications to program management under the acquisition reform initiatives and has the potential for forecasting possible future problems with considerably less program office manpower.

The commander of Air Force Materiel Command (AFMC) identified the requirement to determine the feasibility of modeling the munitions industrial base and simulate replenishment, revealing problems and opportunities for investment while doing so. Air Force ManTech adopted the challenge under Munitions Sector Industrial Base Planning and the OPNET proof-of-concept model was first presented to AFMC Engineering, who championed it for the joint service war game environment.

Due to ensuing changes in technology and program direction, development of software proceeded in increments until the April 1998 final completion. The original concept model is a "quick-look" demo of the feasibility of quick-turn-around modeling of the supply and logistics, and munitions drawdown operations in two distinct modules that feed into the third module (replenishment) that became the OPNET focus. Final OPNET is just that: a replenishment model with analysis capability that can be used standalone or with other supply and theater assessment models, substituting for the first two concept modules. OPNET can be used to graphically link war-fighters' requirements with supply and replenishment capability. Compiled on CD, it is user-friendly software that allows for construction of industrial base hierarchy "trees" that interconnect down to the fifth tier. It is capable of exploring risk, cost, budget, schedule and management options.

OPNET was briefed to General George T. Babbitt, now AFMC commander, as USAF Principal at the 1996 Naval Logistics War Game (NLWG). During NLWG '97, OPNET was presented at the Naval War College Nott Auditorium to participants, and well received. Exhibited at the 1994, 1995 and 1996 Defense Manufacturing Conferences (DMC), and presented in 1995 as a topic under the Advanced Industrial Practices and Tools Mini-Symposium, OPNET was exhibited again in 1996 in multimedia. Sponsored by a commercial software vendor at the Air Force Institute of Technology's Focus on Information Technology Show and presented at two Defense Capabilities Workshops, OPNET has generated considerable interest from industry, the services and other government agencies. The final contractual effort included development of navigation features, an analysis

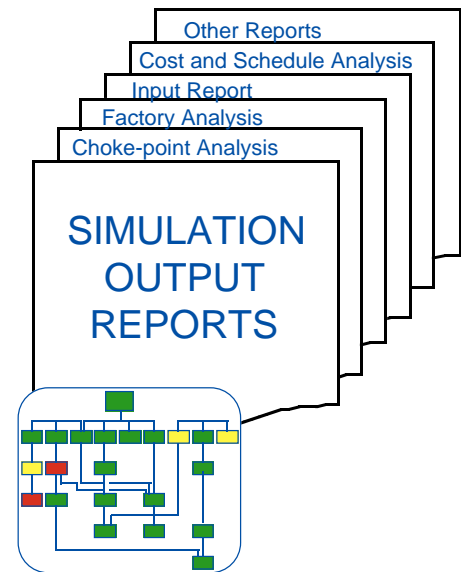
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• *Project Engineer:*
• **Michael Baker**
• **AFRL/MLMA**
• **(937) 255-7700**
• **ext. 523**
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• *Contract Number:*
• **F33615-93-D-5101**
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Reader Response
Number 2

engine, data input enhancement, and analysis report generating capability beyond the ‘what you see is what you get’ display. Letters of support for OPNET have been received from government, academia and industry.

Unique in its ability to provide evaluation of the time phased availability of new weapons as current weapons age, and as new and more capable weapons are being considered for future conflict scenarios, OPNET is a capability to be used in future munitions planning. A demonstration has been performed to evaluate the impact of closing of an Army ammunition plant on the capability to provide needed weapons during a hypothetical conflict. OPNET was presented to the Industrial College of the Armed Forces as a possible tool for training and education of future leaders of the U.S. Air Force into possible current problems and a look into the potential future needs and limitations of the weapons industrial base. The Air Force, Army, and Naval War Colleges also have interest in the use of OPNET as a curriculum item. OPNET, now available, is a powerful tool for measuring the health of the industrial base. It is a flexible state-of-the-art tool that allows the operator to quickly and easily measure the impact of cost, schedule, and program changes which could effect the overall outcome of a major regional conflict. The Independent Review, Analysis, and Recommendations of the Joint Ordnance Wargame (JORDWAR)-97, February 26, 1998, states:



“Issue Recommendations.

Ensure that ammunition planners become familiar with, evaluate, and utilize ... OPNET, as in-theater feasibility and deliberate planning tools.”

As a result of JORDWAR participation, an amendment to the OPNET effort was undertaken to show a proof-of-concept demonstration of its capability to analyze Identification Code items during intra-theater operations from the point of debarkation through port activities, transportation, airbase delivery, and missile assembly area. Since OPNET is a “demand-pull” network system, it quickly provides meaningful information as to the critical choke points within the intra-theater structure. Thus, the original effort to model, and gauge the health of, the munitions industrial base, has resulted in a flexible, state-of-the-art capability to allow an operator to quickly and easily measure the impact of cost, schedule, and program changes which will affect the overall outcome of a campaign. Factoring in industrial capacity, capability and availability, OPNET has been used as a tool to change the methodology and process of supply and replenishment.

In addition to munitions, OPNET is extremely flexible and can be used for other commodities (both defense and commercial), such as lean production planning, joint-service wargames, future technology planning, even the concept of setting up airbases overseas on short notice. OPNET is being leveraged in the Lean Supplier Integration Demonstration (LSID) for technology transfer. Establishment of the OPNET Industrial Base Simulation program enhances contingency planning by allowing decisions to be made in advance which will minimize the effect of the erosion of the most critical resources. It allows the customer to quickly and accurately analyze potential shortfalls in inventory and assess the relative health and ability of the industrial base to meet the future needs of the defense community.

Materials and Manufacturing Directorate hosts Industry Days '98

By Mary Kinsella

Manufacturing Technology Division

Materials and Manufacturing Directorate

The Air Force Research Laboratory's Materials and Manufacturing Directorate held its fourth annual Industry Days conference, March 24-25, at Dayton's Crowne Plaza Hotel.

Over 130 representatives from the Department of Defense, industry, and academia heard presentations highlighting this year's theme – "The Rewards of Change."

Fred Stahl, Technical Director for the Boeing Company, served as moderator for the Success Stories Panel session, which was one of the highlights of Industry Days '98. Although the panel members came from diverse industries — Dick Kleine, Deere and Company, Tim Jubach, Allied Signal, Inc., and Brian Lanoway, Standard Aero — they all addressed a number of common themes. All were very much concerned with adopting best practices. These included benchmarking, and reducing lead/cycle time, floorspace, overhead and direct labor. While they felt that these initiatives were well under way, the challenge of full acceptance and implementation remains. For this to occur, all members of the value chain, from primes to suppliers, must have incentives to pursue and adopt best practices.

Industry Days provides a forum for the Air Force Manufacturing Technology (ManTech) Program to share its Industrial Base Pilot (IBP) programs, concepts and associated results with its government, industrial, and academic partners. An implementation of the Manufacturing 2005 study, the IBP programs have been demonstrating changes in the acquisition and manufacture of military hardware by focusing on business practices, commercial-military integration, and the lean enterprise. Beyond what many studies and analyses have indicated, the IBP programs have shouldered significant risk to demonstrate the cost benefits of changing how DoD does business.

The majority of the conference was devoted to ManTech's three IBP programs. The "Military Products from Commercial Lines" pilot program is demonstrating the production of electronic modules compatible with the F-22 Raptor Advanced Tactical Fighter and the RAH-66 Comanche helicopter, using a commercial automotive manufacturing line. The "Military Products Using Best Commercial/Military Practices" pilot program is building an affordable C-17 horizontal stabilizer in an integrated factory with better quality, reduced weight, and decreased cost when compared to the existing military baseline. The "Lean Implementation Initiative - Modular Factory" targets aircraft, missile and electronic systems to demonstrate a modular factory approach for the manufacture of military products. The benefits include affordability, reduced cycle time, and lower inventory.

The three IBP programs have made major strides in transitioning best practices from the laboratory environment into major production programs. The annual Industry Days conference provides a forum for the pilots to share their findings, lessons learned, and recommendations with the entire acquisition community.

Roadmap Review provides insight on planned research and development activities

Leaders from industry, government and academia are getting together at the Dayton Convention Center July 14-16, to participate in the Air Force Research Laboratory Materials and Manufacturing Directorate (ML) 1998 Roadmap Review.

The event provides insight into planned Air Force materials and manufacturing research and development activities. It also provides an opportunity for participants to offer suggestions and ideas on future directorate research and development efforts.

The event will be hosted by the ML Director, Dr. Vincent J. Russo, who will provide a complete overview of the Directorate. He will report on progress with the recent organizational changes, and will discuss the directorate's mission to help industry maintain an affordable defense materials and manufacturing capability.

For more information on the Roadmap Review, contact the Universal Technology Corporation at (937) 426-2808.

Preparations under way for Defense Manufacturing Conference

The 1998 Defense Manufacturing Conference (DMC '98) will be held Nov. 30 through Dec. 3, in New Orleans, La., at the New Orleans Marriott Hotel.

The conference is hosted by the Joint Defense Manufacturing Technology (ManTech) Panel. This panel identifies and integrates requirements, conducts joint program planning, develops joint strategies and oversees execution of the manufacturing technology programs conducted by the Army, Navy, Air Force, Defense Logistics Agency, and Defense Advanced Research Projects Agency.

DMC '98 will be a forum for presenting and discussing initiatives that address critical defense manufacturing and sustainment needs. The agenda will be structured to provide participants with an overview of defense manufacturing technology and sustainment programs as well as detailed technical discussions relating to the various initiatives and the technology thrusts currently being pursued. Attendees will be presented not only with the status of both government and industry programs, but also with a vision for the future of defense manufacturing and sustainment. Hosted by the Army, this year's conference will pave the way towards future successes in the affordable production and sustainment of both military and commercial products.

Last year's conference, DMC '97, held in Palm Springs, Calif., was attended by over 800 industry and government representatives. In addition to a number of plenary sessions, eight mini-symposia, or technical sessions, were conducted in the areas of metals, composites, and electronics processing and manufacturing; manufacturing and engineering systems; advanced industrial practices; energetics and munitions; supply chain management; and other special topics. Over 80 papers and panel sessions were presented during the mini-symposia.

For more information on DMC '98 call (937) 426-2808 (Fax: 426-8755).

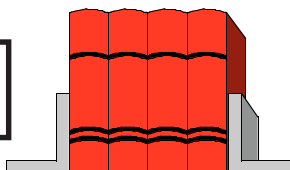
END OF CONTRACT FORECAST

8

| DATE | PROJECT TITLE CONTRACT NO. | PRIME CONTRACTOR | POINT OF CONTACT |
|---------------------------|--|--|-------------------------------------|
| June 1999 Covinton, KY | Hybrid Composites Manufacturing Braiding/ Filament Winding Production F33615-98-C-5101 | A&P Technology Incorporated Covinton, KY | Daniel Brewer (937) 255-7277 |
| June 1998 | Precision High Speed Machining with Vibration Control SPO900-94-C-0010 | Boeing Company, Aerospace Division St Louis, MO | Rafael Reed (937) 255-2413 |
| June 1998 | Practice-Oriented Masters Engineering Program F33615-94-1-4422 | Ohio State University Columbus, OH | Theodore Finnessy (937) 255-4623 |
| June 1998 | Lean Blade Repair Pilot F33615-93-C-4301 | General Atomics Corporation San Diego, CA | Rafael Reed (937) 255-2413 |
| July 1998 | Advanced Fasteners for Low Cost Airframe Assembly and Repair F33615-97-C-5156 | Navmar Applied Science Corporation Warminster, PA | Marvin Gale (937) 255-7277 |
| July 1998 | Advanced Fasteners for Low Cost Airframe Assembly and Repair F33615-97-C-5157 | Damona Service Company Kansas City, KS | Marvin Gale (937) 255-7277 |
| July 1998 | Airborne Warning and Control System (AWACS) Salvageable Electron Gun F33615-96-C-5103 | Litton Corporation, Linear Beam Department San Carlos, CA | P Michael Price (937) 255-2461 |
| July 1998 | Instrument for Rapid Quantitative and Nondestructive Wafer Evaluation F33615-96-C-5108 | Sentec Corporation Walled Lake, MI | Walt Spaulding (937) 255-2416 |
| July 1998 | Laser-Based Reverse Engineering and Concurrent Systems F33615-96-C-5616 | Florida International University Miami, FL | David Slicer (937) 255-7371 |
| July 1998 | Advanced Six-Degree-of-Freedom (6D) Laser Measurement System F33615-96-C-5106 | Automated Precision Incorporated Gaithersburg, MD | Rafael Reed (937) 255-2413 |
| July 1998 | Behavior Analog Fault Modeling F33615-96-1-5603 | University of Iowa Iowa City, IA | William Russell (937) 255-7371 |
| July 1998 | MEREOS - A Product Definition Management System for Enterprise F33615-95-C-5519 | Ontek Corporation Laguna Hills, CA | Wallace Patterson (937) 255-4623 |
| August 1998 | The Effect of Pre-Existing Residual Stress in Dry Superfinish Hard Turning Numerous | Purdue University West Lafayette, IN | David Judson (937) 255-7371 |
| August 1998 | Affordable Tooling for Composite Structures F33615-97-C-5142 | Integrated Composites Incorporated Marina, CA | Marvin Gale (937) 255-7277 |
| August 1998 | Mobile Automated Scanner (MAUS) F33615-91-C-5664 | Boeing Company, Aerospace Division St Louis, MO | Deborah Kennedy (937) 255-3612 |
| August 1998 | System Designer Advisor Baseline Enhancement F33615-96-2-5612 | Texas Instruments Incorporated Lewisville, TX | Daniel Lewallen (937) 255-7371 |

| DATE | PROJECT TITLE CONTRACT NO. | PRIME CONTRACTOR | POINT OF CONTACT |
|----------------|---|--|-----------------------------------|
| August 1998 | Development of Adoptive Modeling Language for Knowledge Base Systems F33615-96-C-5606 | Lockheed Martin Corporation Orlando, FL | Alan Winn (937) 256-9221 |
| August 1998 | Integrated Knowledge Environment - Integrated Product Management (IKE-IPM) F33615-96-C-5109 | Knowledge Base Engineering Incorporated Centerville, OH | David Judson (937) 255-7371 |
| August 1998 | Modular Factory for Electronic Warfare Component Manufacturing F33615-95-2-5564 | Northrop Grumman Corporation Rolling Meadows, IL | Brench Boden (937) 255-7371 |
| August 1998 | Active Matrix Liquid Crystal Display for Manufacturing Technology MDA972-93-2-0016 | Optical Imaging Systems Incorporated Northville, MI | Tony Bumbalough (937) 255-2461 |
| September 1998 | High Performance Underfill Encapsulant for Low-Cost Flip Chip F33615-96-C-5117 | National Semiconductor Corporation Santa Clara, CA | Charles Wagner (937) 255-2461 |
| September 1998 | Flexible Accounting Systems in Dynamic Manufacturing Environments Numerous | Iowa State University Ames, IA | David Judson (937) 255-7371 |
| September 1998 | Innovation, Implementation, and Costs Numerous | Tennessee Technological University Cookeville, TN | David Judson (937) 255-7371 |
| September 1998 | A Methodology for Promoting the Design and Justification of Innovative Solutions to Flexible Manufacturing Problems in Traditional Factories Numerous | New Jersey Institute of Technology Newark, NJ | David Judson (937) 255-7371 |
| September 1998 | Life Cycle Costs of Manufacturing Activities and Technological Innovation Numerous | Texas A&M University College Station, TX | David Judson (937) 255-7371 |
| September 1998 | Low Cost, High Performance, Low Temperature Cofired Ceramic-On-Metal Substrate Technology for Mixed Signal Modules F33615-96-2-5105 | David Sarnoff Research Center Princeton, NJ | Walt Spaulding (937) 255-2416 |
| September 1998 | Solder Jetting for Electronics Manufacturing F33615-97-2-5120 | Microfab Technologies Incorporated Plano, TX | Charles Wagner (937) 255-2461 |
| September 1998 | Manufacturing Technology for Multi- Bandgap Solar Cells F33615-95-C-5561 | Spectrolab Incorporated Sylmar, CA | P Michael Price (937) 255-2461 |
| September 1998 | Ultra-Thin Cast Nickel-Base Alloy Structures F33615-93-C-4305 | United Technologies Corporation West Palm Beach, FL | Rafael Reed (937) 255-2413 |
| September 1998 | Manufacturing Assembly Pilot (MAP) Project F33615-95-2-5518 | Automotive Industry Action Group Southfield, MI | Cliff Stogdill (937) 256-9222 |
| September 1998 | Reasoning in 3-Dimensions: A Common Framework for Design, Manufacturing and Tactical Planning F33615-95-C-5560 | Stanford University Stanford, CA | Jon Jeffries (937) 255-7371 |

Reports



Design and Manufacture of Low Cost Composites, Wing (18th Quarterly Report)

Alog Number: 3925
Contract Number: F33615-91-C-5720
Technical Report Number: MDA B2447-18
Accession Number: N/A
Distribution: LIMITED

Heat Treating Hotline

Alog Number: 3919
Contract Number: F33615-94-2-4414
Technical Report Number: WL-TR-96-8034
Accession Number: ADA321089
Distribution: LIMITED

System Design Advisor

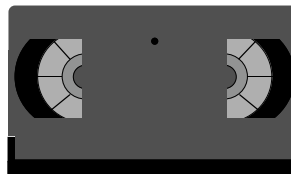
Alog Number: 3926
Contract Number: F33615-94-C-4427
Technical Report Number: WL-TR-96-8029
Accession Number: ADB221453
Distribution: LIMITED

Manufacturing Technology for Silicon-On-Insulator Wafers

Alog Number: 3929
Contract Number: F33615-89-C-5714
Technical Report Number: WL-TR-93-8038
Accession Number: N/A
Distribution: LIMITED

Pollution Prevention Assessments

Alog Number: 3920
Contract Number: F33615-92-D-5812
Technical Report Number: WL-TR-066
Accession Number: N/A
Distribution: LIMITED



Videos

Magna Valve Shot Flow Controller Presentation

Alog Number: 107
Length: 60:00
Distribution: LIMITED

Geometric Modeling Application Program Executive Summary

Alog Number: 104
Length: 8:00
Distribution: LIMITED

Composite Manufacturing Facilities

Alog Number: 106
Length: 5:34
Distribution: LIMITED

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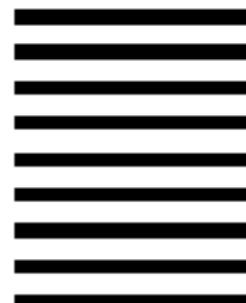


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Summer 1998



The USAF Manufacturing Technology

PROGRAM STATUS REPORT

Summer 1998

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